From: Stoick, Paul T CIV USN (USA) [/o=Organization/ou=First Administrative Group/cn=Recipients/cn=paul.stoick]
Sent: Wednesday, April 17, 2019 2:11 PM
To: Cooper, Jerry [JCooper@GilbaneCo.com]
CC: Acharya, Arvind [AAcharya@GilbaneCo.com]; Gilmore, Clare [CGilmore@GilbaneCo.com]
Subject: FW: Final Issue of HPNS D-1 RACR, Ship Berths FSSR, and NRDL FSSR
Attachments: Final RACR replacement pagesHK.pdf; Final NRDL 040119 Marked Up Pages.pdf

Jerry,

Ok, I think we're getting there.

(1) For the RACR, the RTCs need to be replaced. I reviewed your mark-up and the clean RTC Table edited for Final RACR and they are consistent. The clean Final version of the RTCs will be incorporated into the Final RACR.

From the change page guidance, I'm not clear on pages 5-6, 15-16,31-32, and 53-72. Danielle thinks there were changes related to ARICs, but I didn't see ARIC related language on them. I did find Hamide had a file for them - attached. If this was something settled long ago, I'm good-to-go assuming it captures everything.

(2) For the Ship Berth FSSR, the clean technical memorandum will need to included, removing the Tt references and RTCs replaced. This looks good to go.

(3) For the NRDL FSSR, the RTC addition is good to go, but Danielle was not familiar with the Page 9-10 change-out. It looks like the language that "no discrete radiological object was identified...reference area" was added. Is this something that changed more recently, or earlier on? It doesn't seem like a major issue, just wanted to understand where it was coming from.

I'm also hoping to hear back from admin record with regard to production requirements.

Thanks!

V/r,
Paul

-----Original Message-----
From: Janda, Danielle L CIV USN (USA) <danielle.janda@navy.mil>
Sent: Tuesday, April 16, 2019 2:44 PM
To: Stoick, Paul T CIV USN (USA) <paul.stoick@navy.mil>

Subject: RE: Final Issue of HPNS D-1 RACR, Ship Berths FSSR, and NRDL FSSR

Unless something has changed, this is what should be done for the Final:
The RTCs in the Draft-Final Ship Berths FSSR needs to be replaced with the attached "Appendix N RTC Table-edited for final RACR.pdf". This is what was sent to EPA (see attached email chain). Jerry also had to update the tech memo to remove references to Tt (see attached email from Jerry). I believe what he sent reflects this but you might want to double check it. There are also replacement pages for the RACR that are unchanged based on EPA discussions.

V/r,
Danielle Janda
(619)524-5724

-----Original Message-----
From: Stoick, Paul T CIV USN (USA) <paul.stoick@navy.mil>
Sent: Tuesday, April 16, 2019 12:37 PM
To: Janda, Danielle L CIV USN (USA) <danielle.janda@navy.mil>
Subject: FW: Final Issue of HPNS D-1 RACR, Ship Berths FSSR, and NRDL FSSR

Danielle,

Hate to haunt you with a past project, but Lawrence stopped by a couple of weeks ago and said we are good to go with finalizing the D-1 RACR with the agreed to language. I followed your turnover page, and think we are good to go with the replacement RTCs, but Jerry was apprehensive that he may have not been involved in the back and forth. Jerry also mentioned a technical memo as an appendix.

Do you remember if there was agreed to language, or was it just the RTC replacement (and that's the agreed to language)?

V/r,
Paul

-----Original Message-----
From: Cooper, Jerry <JCooper@GilbaneCo.com>
Sent: Thursday, April 11, 2019 1:20 PM
To: Stoick, Paul T CIV USN (USA) <paul.stoick@navy.mil>
Cc: Acharya, Arvind <AAcharya@GilbaneCo.com>; Gilmore, Clare <CGilmore@GilbaneCo.com>
Subject: [Non-DoD Source] RE: Final Issue of HPNS D-1 RACR, Ship Berths FSSR, and NRDL FSSR

Hi Paul,
To facilitate your final review and any questions you may have for Danielle, attached are the marked up pages that constitute all of the non-editorial changes to the draft final versions of the documents being made to take them to final. Ignore formatting, page numbers, etc., which will all be fixed.

Once you are good with everything, please send the transmittal letter which we will use as authorization to proceed with production and distribution.

Thanks.

Jerry

-----Original Message-----
From: Cooper, Jerry
Sent: Tuesday, April 09, 2019 1:20 PM
To: 'Stoick, Paul T CIV USN (USA)'
Cc: Acharya, Arvind; Gilmore, Clare
Subject: RE: Final Issue of HPNS D-1 RACR, Ship Berths FSSR, and NRDL FSSR

Hi Paul,
We can issue for distribution hardcopy sets of the final versions for the RACR, NRDL FSSR, and the Ship Berths FSSR. You and Arvind can work out the contract details. I haven't checked with Production folks, but this Friday may be too tight. If you are planning on holding and touching base with Danielle when she returns to work next Monday, I am confident we would be able to get the docs issued next week no problem.

Attached are the printed hardcopy replacement page sets for the RACR and the Ship Berths FSSR.

Jerry

-----Original Message-----
From: Stoick, Paul T CIV USN (USA) [mailto:paul.stoick@navy.mil]
Sent: Tuesday, April 09, 2019 12:53 PM
To: Cooper, Jerry
Cc: Acharya, Arvind; Gilmore, Clare
Subject: RE: Final Issue of HPNS D-1 RACR, Ship Berths FSSR, and NRDL FSSR

Jerry,

Both versions of the .pdf work, but the printed is significantly smaller in size. You can send them the printed way.

I need to prepare a transmittal letter - would Friday the 12th work for a date to send out?

V/r,
Paul

-----Original Message-----
From: Cooper, Jerry <JCooper@GilbaneCo.com>
Sent: Monday, April 8, 2019 11:31 AM
To: Stoick, Paul T CIV USN (USA) <paul.stoick@navy.mil>
Cc: Acharya, Arvind <AAcharya@GilbaneCo.com>; Gilmore, Clare <CGilmore@GilbaneCo.com>
Subject: [Non-DoD Source] RE: Final Issue of HPNS D-1 RACR, Ship Berths FSSR, and NRDL FSSR

Paul:
Attached is the NRDL FSSR replacement page .pdf doc prepared using two different approaches. Let me know which works and I'll prep and send the RACR and Ship Berths docs to you the same way.

Thanks.

Jerry

-----Original Message-----
From: Stoick, Paul T CIV USN (USA) [mailto:paul.stoick@navy.mil]
Sent: Monday, April 08, 2019 10:31 AM
To: Cooper, Jerry
Cc: Acharya, Arvind; Gilmore, Clare
Subject: RE: Final Issue of HPNS D-1 RACR, Ship Berths FSSR, and NRDL FSSR

Jerry,

I meant to get back to you sooner - I was TDY up at HPNS most of last week. Thank you for the background - very helpful.

There is a font issue with the pdfs - and I am not able to see the text. Is there any way to change the following fonts to allow me to see the text?

The Final RACR has an issue with the font 'PLIHIH+Cambria-Bold'
The Final Ship Berth FSSR replacement pages has an issue with the font 'MLNEKO+Cambria-Bold'
The Final NRDL FSSR has an issue with the font 'IJIKHE+Cambria-Bold'
No font issue with the change out guidance sheet.

Was the change page agreement made a while back? I'm just wondering given the long delays and informal dispute, if it would make sense to produce a

final document. If the number of change pages are limited, then should be
fine with that approach.

Thanks!!

V/r,
Paul

-----Original Message-----
From: Cooper, Jerry <JCooper@GilbaneCo.com>
Sent: Tuesday, April 2, 2019 1:29 PM
To: Stoick, Paul T CIV USN (USA) <paul.stoick@navy.mil>
Cc: Acharya, Arvind <AAcharya@GilbaneCo.com>; Gilmore, Clare
<CGilmore@GilbaneCo.com>
Subject: [Non-DoD Source] Final Issue of HPNS D-1 RACR, Ship Berths FSSR,
and NRDL FSSR

Paul,

Here's some background that you may already be aware of. The D-1 RACR includes three documents that are to be issued final simultaneously. They are: (1) D-1 RACR, (2) Ship Berths FSSR, and (3) NRDL FSSR. Two issues primarily prevented the three documents from going to final nearly 1 ½ years ago: (1) technical constraints on Gilbane being able to recommend unrestricted release for Parcel D-1 soil below 2 ft bgs, and (2) resolution of EPA's concern regarding Po-210 and the bollards. With the Navy having resolved and/or taken a position regarding these outstanding issues, the three documents can move to final.

Pursuant to the Navy's agreement with Gilbane, the draft final versions of the documents will be finalized by issuance of replacement pages and new CDs. No complete hardcopy documents will be produced, just replacement pages.

Attached are the sets of draft final-to-final replacement pages for the D-1 RACR, Ship Berths FSSR, and NRDL FSSR. Also attached is a Sheet Change-Out Guide. Please review and approve. Gilbane will then prepare, issue, and distribute hard copy replacement page sets for the hardcopy document holders, and complete copies on CD for everyone else.

The whole thing has a lot of history behind it. Let me know what questions we can answer and what else, if anything, you'd like us to do.

Thanks.

Jerry

Jerry Cooper, CHP, PMP | Principal Health Physicist/Corporate RSO | Gilbane
1655 Grant Street, Suite 1200 | Concord, CA 94520 | www.gilbaneco.com
<http://www.gilbaneco.com/>
(360) 751-4172

human activities. Reference areas provide locations for making background measurements to compare with survey unit data.

Certain radionuclides may occur at significant levels as part of background in the media of interest (e.g., soil). Examples include members of the naturally occurring uranium, thorium, and actinium series.

An area northwest of Ship Berth 29 in Parcel D-1, shown in Exhibit 1, was used as the soil reference area. It has no history of radiological use and its surroundings, vegetation, and overall topography and proximity are similar to the former NRDL site. Also it has been used in multiple Navy projects at HPNS over a period of several years to establish a background concentration for Ra-226 (none assumed for either Sr-90 or Cs-137). No discrete radiological objects have been identified in or recovered from the reference area. The closest object found was approximately 30 m north of the reference area.

Twenty samples were collected systematically by another Navy contractor from an area between Building 526 and Berth 29 for use as a reference area population for data comparison. The reference area sample results provide a basis for net activity concentration. One hundred percent of the samples were analyzed by gamma spectroscopy and 10 percent (two samples) were also analyzed for Pu-239 and Sr-90 at a DoD ELAP accredited laboratory (TestAmerica, St. Louis) for use as reference area definitive data.

The reference area sample analytical results are summarized in Appendix B. Analytical results for Sr-90, Cs-137, and Pu-239 are included for information only as corrections for background were made only for Ra-226. Ra-226 was detected above the MDC in each of the 20 samples. The average reference area activity for Ra-226, measured by a 21-day in-growth of the 609.31 kilo-electron volt (keV) gamma energy peak for bismuth-214, was determined to be 0.375 pCi/g. This places the clean-up goal at 1.375 pCi/g of Ra-226. The average value (0.375 pCi/g) was used for background subtraction of Ra-226 for dose and risk modeling.

4.4 STATISTICAL TESTS

MARSSIM (DoD et al., 2000) recommends the use of the WRS test to conservatively evaluate field results. The WRS test is a two-sample, nonparametric procedure that can be used to

NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
SAN DIEGO, CALIFORNIA

FINAL REMOVAL ACTION COMPLETION REPORT
RADIOLOGICAL REMEDIATION AND SUPPORT
PARCEL D-1 PHASE II
HUNTERS POINT NAVAL SHIPYARD
SAN FRANCISCO, CALIFORNIA

~~MAY~~ 2018

STATEMENT A – Approved for public release; distribution is unlimited

DCN: ITSI-0808-0004-0073

NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
SAN DIEGO, CALIFORNIA

FINAL REMOVAL ACTION COMPLETION REPORT
RADIOLOGICAL REMEDIATION AND SUPPORT
PARCEL D-1 PHASE II
HUNTERS POINT NAVAL SHIPYARD
SAN FRANCISCO, CALIFORNIA

~~MAY~~ 2018

STATEMENT A – Approved for public release; distribution is unlimited

DCN: ITSI-0808-0004-0073

NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
SAN DIEGO, CALIFORNIA

FINAL REMOVAL ACTION COMPLETION REPORT
RADIOLOGICAL REMEDIATION AND SUPPORT
PARCEL D-1 PHASE II
HUNTERS POINT NAVAL SHIPYARD
SAN FRANCISCO, CALIFORNIA

MAY 2018

Prepared for NAVFAC Southwest by:

Gilbane Federal
1655 Grant Street, Suite 1200
Concord, California 94520

Contract Number N62473-10-D-2227
Contract Task Order 0004
Document Control Number: ITSI-0808-0004-0073

Jerry Cooper, CHP, Gilbane Principal Health Physicist/Corporate RSO

Clare Gilmore, Gilbane Project Manager

This page intentionally left blank.

TABLE OF CONTENTS

LIST OF EXHIBITS

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ATTACHMENTS

ABBREVIATIONS AND ACRONYMS

μR/hr	microroentgens per hour
AM	Action Memorandum
ANL	Argonne National Laboratory
ARIC	area requiring institutional controls
ARS	American Radiation Services International, Inc.
bgs	below ground surface
Bi-214	bismuth-214
C&T	Curtis and Tompkins, LLC
CDPH	California Department of Public Health
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
cm	centimeter
cm^2	square centimeter
cps	counts per second
Cs-137	cesium-137
CSO	Caretaker Site Office
CTO	contract task order
DCP	Dust Control Plan
DoD	U.S. Department of Defense
dpm/100 cm^2	disintegrations per minute per 100 square centimeters
ELAP	Environmental Laboratory Accreditation Program
ELCR	excess lifetime cancer risk
EPA	U.S. Environmental Protection Agency
FCR	field change request
FSS	final status survey
ft	foot, feet
ft^2	Square feet
GEL	GEL Laboratories, LLC
Gilbane	Gilbane Federal
GPS	global positioning system
GWS	gamma walkover survey
HPNS	Hunters Point Naval Shipyard
HRA	Historical Radiological Assessment
IAEA	International Atomic Energy Agency
IR	installation restoration
K-40	potassium-40
keV	kilo-electron volts
LLRW	low-level radioactive waste
LUC RD	land use controls remedial design
m	meter(s)
m^2	square meter(s)
m^3	cubic meter(s)
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDC	minimum detectable concentration

mrem/yr	millirem per year
NAVSEA	Naval Sea Systems Command
Navy	U.S. Department of the Navy
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NELAP	National Environmental Laboratory Accreditation
NIOSH	National Institute of Occupational Safety and Health
NRC	U.S. Nuclear Regulatory Commission
NRDL	Naval Radiological Defense Laboratory
OSWER	Office of Solid Waste and Emergency Response
pCi/g	picocuries per gram
Po-210	polonium-210
Pu-239	plutonium-239
QCSR	quality control summary report
Ra-226	radium-226
RACR	Removal Action Completion Report
RASO	Radiological Affairs Support Office
RESRAD	RESidual RADioactivity
RMP	Radiological Management Plan
RO	radioactive object
ROD	Record of Decision
ROI	regions of interest
ROICC	Resident Officer in Charge of Construction
RPM	Remedial Project Manager
RPP	Radiation Protection Plan
RSY	radiological screening yard
SAP	Sampling and Analysis Plan
Shaw	Shaw Environmental & Infrastructure, Inc.
Sr-90	strontium-90
SSSD	sanitary sewer and storm drain
SUPR	Survey Unit Project Report
SUPRA	Survey Unit Project Reports Abstract
Synectics	Environmental Synectics, Inc.
TCRA	time-critical removal action
TEDE	total effective dose equivalent
TSP	task-specific plan

EXECUTIVE SUMMARY

This radiological removal action completion report documents the completion of the Phase II removal actions conducted in Parcel D-1 at the Hunters Point Naval Shipyard, San Francisco, California. It addresses the remaining site features in Parcel D-1 identified as radiologically impacted in the *Final Historical Radiological Assessment, Volume II, History of the Use of General Radioactive Materials, 1939—2003, Hunters Point Shipyard, San Francisco, California* (HRA; Naval Sea Systems Command [NAVSEA], 2004) not addressed during Phase I. Specifically, these are:

- Remaining sanitary sewer and storm drain (SSSD) lines;
- Former Naval Radiological Defense Laboratory (NRDL) site;
- Ship Berths 14, 21, 22, and 29; and
- Railroad tie stockpiles.

The removal actions were to designed to (1) substantially reduce ionizing radiation to clean-up goals, and (2) eliminate identified pathways of exposure to ionizing radiation in accordance with the *Final Basewide Radiological Removal Action Action Memorandum—Revision 2006, Hunters Point Shipyard, San Francisco, California* (AM; U.S. Department of the Navy [Navy], 2006) and the *Execution Plan: Parcel D-1 Phase II Radiological Remediation and Support, Hunters Point Naval Shipyard, San Francisco, California* (ITSI Gilbane, 2013b). The radionuclides of concern were cesium-137, radium-226, strontium-90, and plutonium-239.

The remaining SSSD lines and railroad tie stockpiles were removed. Material found to be above the AM (Navy, 2006) clean-up goals was properly disposed of off-site. A final status survey was performed of the former NRDL site and the ship berths. Survey and sampling results confirm that surface soil and other material left in-place and/or re-used as backfill meet the Navy's clean-up goals. Remaining site features in Parcel D-1 identified as radiologically impacted in the HRA (NAVSEA, 2004) have been addressed.

Dose and risk modeling was performed using sample analytical results. Modeling resulted in a maximum dose of 1.4 millirem per year (mrem/yr) and a maximum excess lifetime cancer risk (ELCR) of 2.8×10^{-5}. This demonstrated that the dose and risk, under the conservative residential farmer exposure scenario, were below the project dose limit of 12 mrem/yr and an

ELCR of 3 x 10^{-4}. The inclusion of ingestion-related pathways in the modeling assured that dose and risk results are well within project limits. If the modeling does not take into account the ingestion-related pathways the maximum dose and risk are reduced by 50 percent. Dose and risk modeling that considers reasonably anticipated reuse in accordance with the reuse plan (i.e., reuse that does not include ingestion of produce grown in native soil) results in the maximum dose dropping from 1.4 to 0.63 mrem/yr, and the maximum ELCR from 2.8 x 10^{-5} to 1.4 x 10^{-5}. These dose and risk results are more appropriate because they reflect actual site conditions for the residential scenario, which is the most conservative planned future use.

Once the Phase II removal actions were completed, survey and sampling were performed over a large portion of Parcel D-1 to address radiation anomalies that were identified outside of areas identified as radiologically impacted. Discrete radioactive objects (ROs) were removed and subsequently disposed of off-site. There are two important points to be made:

- ROs recovered outside of areas previously identified by the HRA (NAVSEA, 2004) as radiologically impacted do not appear to be from surface-related activities involving radioactive material. Their suspected source is material dredged from San Francisco Bay used to create the present shoreline. Since radioluminescent devices containing Ra-226 were used on ships, ship decontamination, repair, and dismantling activities occurring at or near piers could have resulted in deck markers, gauges, and small metal pieces being present in the dredge material.
- Based on the post-removal survey and sampling results, there is a high degree of confidence that discrete ROs in soil to a depth of 2 feet (ft) below ground surface (bgs) have been identified and recovered.

Based on the above, there is the potential for ROs to be present in material below 2 ft bgs in areas where shoreline expansion has occurred since 1946 (i.e., where dredged material from the Bay was used to create the present shoreline). Based on the Navy's understanding of how shoreline expansion occurred, the potential is largely limited to areas around the 1946 shoreline (Exhibit 8-8). The likelihood of ROs moving away from the 1946 shoreline is considered incidental and of low probability. Land use and activity restrictions currently in place prohibit land-disturbing activities throughout Parcel D-1 in the interim until the Land Use Controls Remedial Design in the *Final Design Basis Report For Parcel D-1, Hunters Point Naval Shipyard, San Francisco, California* (ChaduxTt, 2011) is amended to appropriately mitigate any risk to human health relating to the potential presence of ROs in material below 2 ft bgs.

In addition to the Phase II removal actions, radiological survey and sampling of Parcel D-1 areas outside of those identified as radiologically impacted in the HRA (NAVSEA, 2004) was performed to address discrete radiation anomalies that were identified previously by a Navy contractor near Ship Berths 22 and 29.

The Phase II removal action addressed chemical contamination only in relation to re-use as potential backfill material or waste characterization for disposal of excavated soil derived from removal of the SSSD lines in accordance with the *Execution Plan: Parcel D-1 Phase II Radiological Remediation and Support, Hunters Point Naval Shipyard, San Francisco, California* (Execution Plan; ITSI Gilbane, 2013b). This radiological RACR does not address chemical contamination.

1.3 CURRENT AND FUTURE LAND USE

There is no current use of Parcel D-1. Following this removal action, and after other additional remedial activities are completed, Parcel D-1 will be transferred to the City and County of San Francisco for conversion to non-defense re-use. The future planned use of Parcel D-1 is mixed use residential and shoreline open space as described by the *Hunters Point Shipyard Redevelopment Plan* (San Francisco Redevelopment Agency, 2010). Public recreation access will be provided to the San Francisco Bay waterfront, and include open spaces, viewing area of the water and historic Shipyard facilities, the San Francisco Bay Trail, and restorative habitat areas.

1.4 WORK CONTROL

A series of work plan documents were prepared to guide completion of work activities performed as part of the Phase II removal action. These supporting documents are incorporated by reference and are available for review through the Environmental Restoration Program Record File (see Section 11.1).

1.4.1 Basewide Radiological Management Plan

The *Basewide Radiological Management Plan, Hunters Point Naval Shipyard, San Francisco, California* (RMP; ITSI Gilbane, 2013a) describes the survey and decontamination procedures and methodologies that were implemented by Gilbane in support of the radiological release of buildings, sites, structures, areas, materials and equipment at HPNS. The Basewide Storm Drain and Sanitary Sewer Removal Plan, included as Attachment 1 to the RMP (ITSI Gilbane, 2013a), describes the scope and approach for removing SSSD lines and achieving radiological release of related excavated areas at HPNS.

1.4.2 Parcel D-1 Execution Plan

The Execution Plan (ITSI Gilbane, 2013b) provided guidance and procedures for performing the radiological survey of radiologically impacted structures, removal of SSSD lines, radiological screening yard (RSY) operations, and supporting off-site laboratory operations. The Execution Plan (ITSI Gilbane, 2013b) was supported by the following plans which were included as attachments to it:

- Sampling and Analysis Plan (SAP; Attachment 1),
- Contractor Quality Control Plan (Attachment 2),
- Radiation Protection Plan (RPP; Attachment 3),
- Dust Control Plan (DCP; Attachment 4)
- Stormwater Pollution Prevention Plan (Attachment 5)
- Accident Prevention Plan and Site Safety and Health Plan (Attachment 6)

1.4.3 Design Plan

The *Parcel D-1 Phase II Design Plan: Storm Drain and Sanitary Sewer Removal, Hunters Point Shipyard, San Francisco, California* (Design Plan; ITSI Gilbane, 2013c) included guidance for SSSD line excavation and site restoration activities within Parcel D-1, in addition to the design drawings for SSSD line removal activities.

1.4.4 Task-Specific Plans

Task-specific plans (TSPs) were developed for the FSS of the former NRDL site and the ship berths. They are:

- *Task-Specific Plan: Former Naval Radiological Defense Laboratory Site Final Status Survey, Hunters Point Naval Shipyard, San Francisco, California* (NRDL Site TSP; ITSI Gilbane, 2013d)
- *Task-Specific Plan: Radiological Survey and Release of Ship Berths 14, 21, 22, and 29, Hunters Point Naval Shipyard, San Francisco, California* (Ship Berths TSP; ITSI Gilbane, 2013e)

The TSPs describe the survey activities conducted in accordance with the guidelines in the *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM) (NUREG-1575; U.S.

3.0 FIELD ACTIVITIES OVERVIEW

Gilbane holds radioactive material licenses from both the NRC (License No. 04-29353-01) and the State of California (License No. 9748-07), and performed CTO 0004 under those license authorities. Gilbane coordinated license responsibilities and management of radioactive material, including waste, with the Navy and other HPNS contractors providing radiological services via a memorandum of understanding. Parties included TetraTech EC, Inc.; B & B Environmental Safety, Inc.; Chicago Bridge & Iron; and Gilbane. LLRW disposal was not included as part of CTO 0004. The transportation and disposal of LLRW and non-radiological waste were conducted under separate HPNS basewide waste disposal contracts overseen by the Navy.

3.1 PERMITS AND NOTIFICATIONS

While permits are not required for TCRA operations, the Navy complies with the substantive requirements of applicable and relevant permits. Necessary authorizations were obtained from the Resident Officer in Charge of Construction (ROICC) and the HPNS Caretaker Site Office (CSO) for implementing and completing the work. Because work activities were conducted along well-traveled streets, the remedial project manager (RPM), CSO, ROICC, HPNS tenants, and HPNS security were notified of road closures and changes to traffic flow that was necessary to support the work.

Storm water management was performed in substantive compliance with the General Construction Activity Storm Water Permit program set forth by the California Regional Water Quality Control Board General Permit No. CAS000002, Water Discharge Requirements for Discharges of Storm Water Runoff Associated with Construction Activity.

3.2 GAMMA WALKOVER SURVEY

A gamma walkover survey (GWS) was performed prior to sampling to identify locations with the highest potential for elevated residual radioactivity based on their measured levels of gamma radiation. These locations were routinely selected for biased sampling. The GWS was performed using a Radiation Solutions, Inc., RS-700 self-contained mobile gamma ray detection system. The RS-700 system was mounted on a mobile platform (e.g., small tractor or boom lift) equipped with an adjustable throttle to allow for speed control. The detector was mounted at a height of approximately four inches (0.1 m) above the surface, moving at a speed of 1.5 ft (0.5 m) per second, with each pass spaced 1.5 ft (0.5 m), or less based on detector field of view, from the previous pass to achieve 100 percent coverage of the area being surveyed. The spacing of each pass coupled with the detector sensitivity and field of view ensured high-density survey coverage of the area being scanned.

GWS data were position correlated using a global positioning system (GPS) receiver mated with a graphical interface system field device. The GPS antenna was mounted above the detector in such a manner to limit obstructions to aid in keeping the best satellite resolution possible. Position-correlated measurement data were logged automatically at one-second intervals. Collected data were retrieved from the RS-700 and processed using numerical and graphical methods. First, the data were plotted to ensure adequate scan coverage. A tractor speed histogram was developed using the position-correlated data as a quality control check to verify the proper speed of the detector over the ground. The data were checked for errors as well as examined for potential outliers and other anomalous features. Descriptive statistics (e.g., range, median, mean, and standard deviation) were used to assess the data set. The data were graphed on a cumulative frequency diagram to test departure from normality and to reveal characteristics of the data distribution such as dissimilar populations and data set outliers that may not be apparent otherwise. Locations with measurements greater than three standard deviations above the data set mean were routinely selected for biased sampling.

Surveys to further delineate suspected contaminated areas were performed using a Ludlum Model 44-10 gamma scintillation detector coupled to a Ludlum Model 2221 ratemeter scaler.

RS-700 and Ludlum Model 44-10 instrument data are included in Appendix B.

3.3 SAMPLING AND ANALYSIS

Sampling and analysis were performed in accordance with the SAP, included as Attachment 1 to the Execution Plan (ITSI Gilbane, 2013b). Except where available material to sample was limited, samples collected were approximately 1,000 grams in size. Visually identifiable foreign objects and debris were removed manually in the field. Samples were bagged in one-gallon resealable plastic bags, numbered, logged, and sent for laboratory analysis. Each sample was labeled and assigned a unique sample identification number. The samples were turned over to

15 cm were transferred along with the surrounding soil to the RSY for processing. No piping or other material greater than 6 inches (15 cm) was sent to the RSY, nor was non-soil material, that was encountered during excavation. Material that was identified as radioactive waste was handled as described in Section 9.1. Non-soil material was characterized, handled, and properly disposed of. Because it is considered radiologically contaminated, non-soil material was handled within a radiologically controlled area until survey and sampling data demonstrated otherwise. Care was taken to contain silt and debris that was inside the piping.

4.7 TRENCH SURVEY AND SAMPLING

Survey and sampling of the excavated trench surfaces (floor and sidewalls) were performed once soil excavation and pipe removal were complete. Where residual radioactivity above the clean-up goals was identified, the area was remediated (i.e., soil was removed) and resampled. In the event no residual radioactivity above the clean-up goals was identified (i.e., no remediation is required), then the survey data were used to demonstrate that the residual radioactivity levels inside the excavated trench meet the clean-up goals. Trench survey units did not exceed 10,760 ft^2 (1,000 m^2) in total surface area (trench floor and sidewalls).

A GWS was performed over 100 percent of the trench surfaces. The RS-700 system mounted on an engine powered telescopic boom lift was used. The boom lift served as the working platform for the technician and provided the ability to survey the trench without worker entry. The detector was mounted on an arm extending from the boom lift and controlled by the technician, allowing repositioning of the detector for improved trench floor and wall surveying. The detector was mounted either vertically or horizontally to enable survey of the trench floor and walls, respectively.

Twenty random-start systematic and up to 10 biased samples per trench survey unit were collected from the exposed trench surfaces and analyzed. Where residual radioactivity exceeding the clean-up goals was identified within the trench, the area was remediated (i.e., excavated) and post-remediation survey and sampling were performed to verify the clean-up goals are met. Samples were also collected along the pipe footprint in the trench based on contamination found on the removed SSSD lines, and to bound remediated areas.

The number and type of samples collected are shown in Exhibit 4-5. The sample results, summarized in Exhibit 4-6, demonstrate the effectiveness of the removal action. A single sample location in Zone G reported a Cs-137 concentration of 0.151 pCi/g, which exceeds Cs-137 clean-up goal of 0.113 pCi/g. A single sample location in Zone D reported a Sr-90 concentration of 0.404 pCi/g, which exceeds Sr-90 clean-up goal of 0.331 pCi/g. The soil containing the elevated radioactivity was removed and disposed as LLRW. Bounding samples were collected to verify remaining soil concentrations were below the clean-up goals.

Exhibit 4-5. Trench Sample Collection

Parameter	Number
Number of trench survey units	17
Systematic samples	340
Biased (based on GWS results) samples	110
Pipe footprint/bounding samples	88
Total samples collected	538

Exhibit 4-6. Summary of Trench Sample Results

Parameter	Radionuclide of Concern		
	Ra-226	Cs-137	Sr-90
Samples analyzed	538	538	67
Samples w/concentration > MDC	536	54	1
Number of sample exceedances	0	1[a]	1[b]
Lowest MDC (pCi/g)	0.0304	0.00917	0.0337
Highest MDC (pCi/g)	0.0508	0.0243	0.165
Minimum concentration (pCi/g)	< MDC	< MDC	< MDC
Maximum concentration (pCi/g)	1.03	0.151[a]	0.404[b]

Notes:
[a] Single sample location in Zone G reported 0.151 pCi/g, which exceeds Cs-137 clean-up goal of 0.113 pCi/g. Soil containing elevated radioactivity removed and disposed as LLRW. Highest post-remediation (i.e., remaining) Cs-137 concentration was 0.107 pCi/g.
[b] Single sample location in Zone D reported 0.404 pCi/g, which exceeds Sr-90 clean-up goal of 0.331 pCi/g. Soil containing elevated radioactivity removed and disposed as LLRW. Highest post-remediation (i.e., remaining) Sr-90 concentration was below MDC.

Dose and risk modeling of the trench surfaces was performed in RESRAD using the analytical results of samples collected from both systematically-spaced and biased locations representing the post-remediation or “as-left” trench surfaces. Modeling resulted in a maximum dose for the trenches in any zone of 1.2 mrem/yr with an ELCR of 2.0×10^{-5}.

Exhibit 8-5. Field Investigation Sample Collection

Type of Sample	Number
Bounding samples (excavation floor and walls)	20
Biased (based on highest count rate) samples	12
Stockpile samples (soil removed from excavation)	16
Total samples collected	48

Exhibit 8-6. Summary of Field Investigation Sample Results

Parameter	Radionuclide of Concern	
	Ra-226	Cs-137
Samples analyzed	48	48
Samples w/concentration > MDC	47	1
Number of sample exceedances	0	0
Lowest MDC (pCi/g)	0.070	0.038
Highest MDC (pCi/g)	0.170	0.070
Minimum concentration (pCi/g)	< MDC	< MDC
Maximum concentration (pCi/g)	0.904	0.046

8.3 ASSESSMENT OF RESULTS

As the result of the post-removal survey and sampling, four discrete ROs were identified and recovered. These are in addition to the eight ROs that were recovered earlier during the removal action implementation. The four ROs were recovered from investigation locations identified by analyzing the GWS data by ROI and contour mapping the results based on z-score. The results demonstrate how this method enables the discovery of discrete ROs with lower activities at greater depths (see Exhibit 8-7). The four ROs (RO-09 through -12) were recovered at depths between 1 to 3 ft bgs with radiation levels as low as 25 microroentgens per hour (μR/hr). The preceding eight ROs either had much higher activity or were recovered at a shallower depth.

8.3.1 Radiological Objects

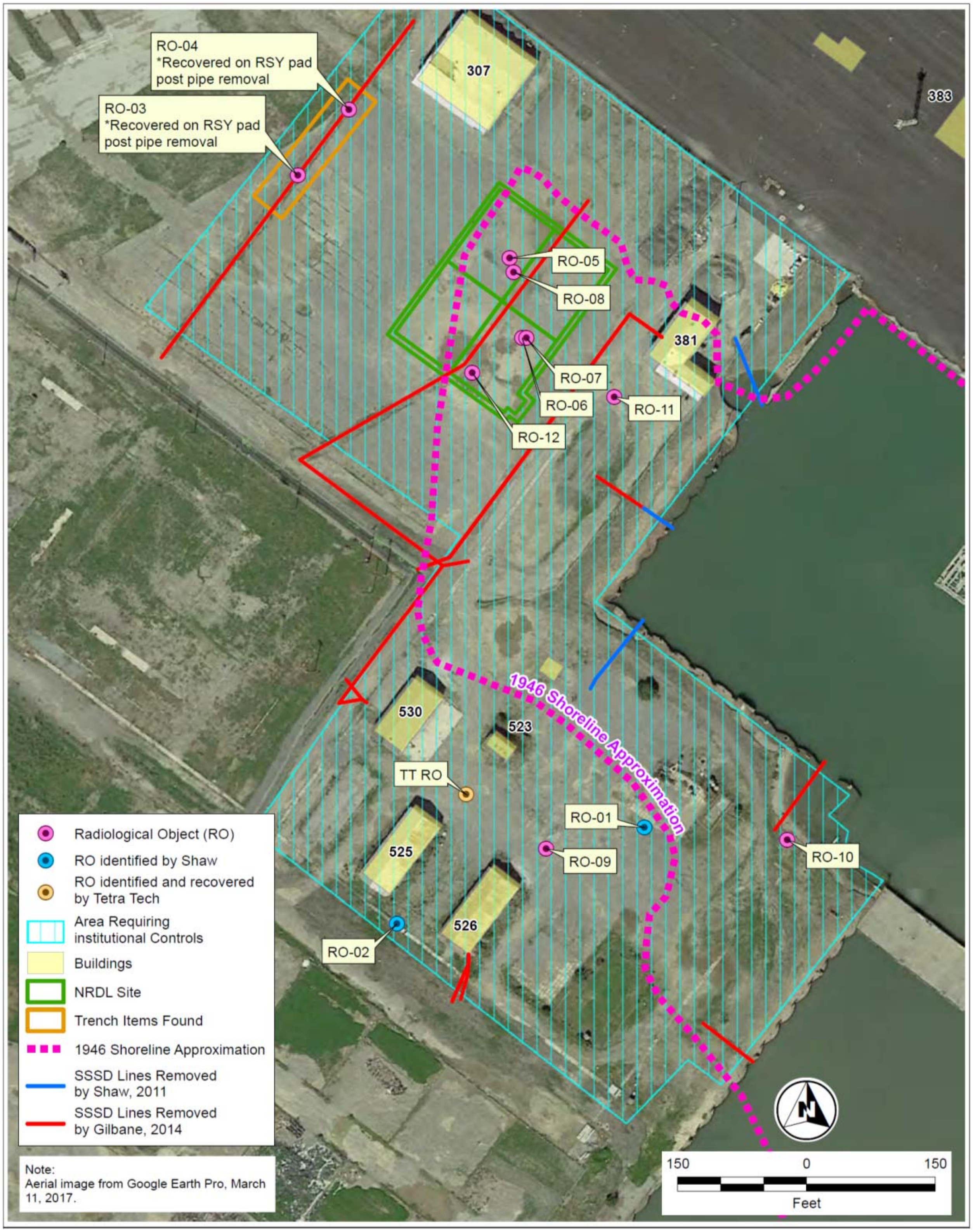
Exhibit 8-8 shows the locations where the 12 ROs were recovered. Five ROs were recovered within the footprint of the former NRDL site, which was identified as a radiologically impacted area. Two ROs were recovered during excavation of SSSD lines. The remaining five ROs were recovered outside of areas identified in the HRA (NAVSEA, 2004) as radiologically impacted.

Exhibit 8-7. Recovered Radioactive Object Data

ID	How Identified	Highest Reading[a] (μR/hr)	Recovery Depth bgs (ft)	Description
RO-01	Previously identified by Shaw	3,200	0.5	Button or deck marker
RO-02	Previously identified by Shaw	23	0.5	Small chunk of soil with visible rust particles in it
RO-03	Located by GWS on RSY Pad D-28, with Soil Pile D0034, from Trench # 04-PD-015, Zone O	4,600	N/A	Deck marker
RO-04	Located by GWS on RSY Pad D-03, with Soil Pile D0036, from Trench # 04-PD-016, Zone P	4,900	N/A	Corroded and damaged deck marker
RO-05	Located by GWS of NRDL-NW survey unit after asphalt removal	1,500	0.5	1 ½ inch piece that looked like it had a clip on one side
RO-06	Located by the GWS of NRDL-SE survey unit after asphalt removal	480	1.5	Small chunk of soil with visible rust particles in it
RO-07	Located using Ludlum Model 44-10 after the removal of RO-06	60	1.5	Small chunk of soil with visible rust particles in it
RO-08	Located using Ludlum Model 44-10 while collecting biased samples around sample 04-PD-NRDL-NW-013	500	2-3	Corroded and damaged can of some materials
RO-09	Located using ROI contour mapping of GWS results.	460	2-3	Corroded and damaged metal gauge or can
RO-10	Located using ROI contour mapping of GWS results.	420	2-3	Small chunk of soil with visible rust particles in it
RO-11	Located using ROI contour mapping of GWS results.	25	1-2	Small chunk of soil with visible rust particles in it
RO-12	Located using ROI contour mapping of GWS results.	33	1-2	Small chunk of soil with visible rust particles in it

Note:
[a]on-contact or near-surface reading

Exhibit 8-8. Locations where Discrete Radioactive Objects were Recovered



There are two important points to be made. First, the source of the five ROs recovered outside of areas previously identified by the HRA (NAVSEA, 2004) as radiologically impacted do not appear to be from surface-related activities involving radioactive material. Their suspected source is dredge material from San Francisco Bay used to fill in Parcel D-1. To illustrate this, an approximation of the 1946 shoreline was overlaid on the Exhibit 8-8 map showing the locations where discrete ROs were recovered. Material dredged from the Bay was used to create the present shoreline. Since radioluminescent devices containing Ra-226 were used on ships, ship decontamination, repair, and dismantling activities occurring at or near piers could have resulted in deck markers, gauges, and small metal pieces being present in the dredge material. Grading of dredge material is a ready explanation for the discovery of ROs outside of, but adjacent to, the 1946 shoreline.

Second, based on the post-removal survey and sampling results, there is a high degree of confidence that discrete ROs in the soil to a depth of 2 ft bgs have been identified and recovered. This is based on the sensitivity of the method described in Section 8.1. To illustrate, post-processing and analysis of the GWS data resulted in the identification and recovery of an RO within the former NRDL site after it had undergone an FSS. The GWS performed as part of the FSS did not identify the RO directly; however, post-processing and analysis of the GWS data from the former NRDL site and surrounding areas resulted in the location being investigated and the object being found.

Building on the two points above, there is the potential for ROs to be present in material below 2 ft bgs in Parcel D-1 Phase II areas where shoreline expansion has occurred in Parcel D-1 since 1946 (i.e., where dredge material from the Bay was used to create the present shoreline). Based on the Navy's understanding of how shoreline expansion occurred, the potential is largely limited to areas around the 1946 shoreline. The likelihood of ROs moving away from the 1946 shoreline is considered incidental and of low probability. The potential for ROs at depth does not present a dose or risk greater than the results of the dose and risk modeling summarized in Section 13.2. Land use and activity restrictions that are currently in place prohibit land-disturbing activities throughout Parcel D-1 in the interim until the Land Use Controls Remedial Design (LUC RD) in the *Final Design Basis Report For Parcel D-1, Hunters Point Naval*

Shipyard, San Francisco, California (ChaduxTt, 2011) is amended to appropriately mitigate any risk to human health relating to the potential presence of ROs in material below 2 ft bgs.

Figures found in the HRA (NAVSEA, 2004), particularly Appendix C, illustrate what the area looked like before and after it was developed. There is some degree of uncertainty regarding the 1946 shoreline represented in Exhibit 8-8 supporting a conceptual site model where dredge material likely was used to build up the elevation of existing near-shore areas, as illustrated in Exhibit 8-9.

8.3.2 Conceptual Site Model

Grading and construction activities in the newly created and built-up land areas are the most likely explanation for the discovery of ROs outside of, but adjacent to, the 1946 shoreline approximation. Therefore, a buffer zone extending beyond the 1946 shoreline approximation is included with the 2 ft bgs restriction for Parcel D-1 Phase II (see Exhibit 8-8). .

Exhibit 8-9. Illustration of Backfilled Near-Shore Areas

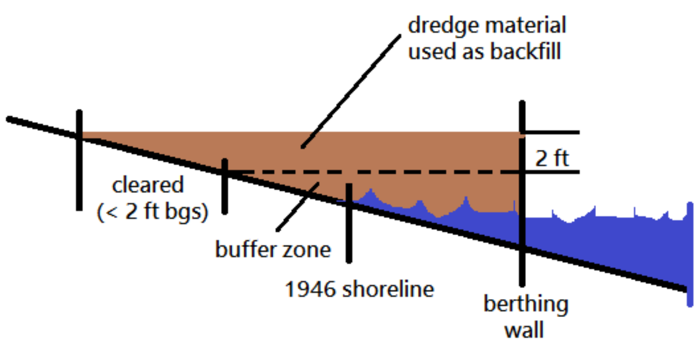


Exhibit 8-9 illustrates the purpose of a buffer zone. Though discrete ROs may have been identified and recovered to a depth of 2 ft bgs, areas backfilled with dredge material to depths greater than 2 ft bgs may extend further inland from the 1946 shoreline. The actual extent is a function of the original near-shore elevation gradient and the post-backfill final grade. That information is not available; therefore, an appropriately conservative buffer zone – encompassing discrete ROs found to date - should be established.

Three general considerations were used in placing the buffer zone shown in Exhibit 8-8. The area excluded from the area requiring restrictions does not require further action because:

1. It is furthest from the shoreline and represents the land area least likely to have been built up using dredge material;
2. It is radiologically dissimilar from the southeast portion of the RSY-2 screening pad area where the discrete ROs were found (see Exhibit 8-3); and
3. Over 2,200 linear ft of trenches were excavated ranging in depth from 2 to 8 ft. The 1,962 cy of excavated soil was radiologically screened without finding a single discrete RO.

The LUC RD (ChaduxTt, 2011), when amended, will identify the buffer zone extending beyond the 1946 shoreline approximation area as a radiological area requiring institutional controls (ARIC) below 2 ft bgs as depicted in Exhibit 8-8.

9.0 WASTE MANAGEMENT

Waste was managed in accordance with the waste management practices included in Section 3.4 of the Execution Plan (ITSI Gilbane, 2013b). Waste materials generated during this project included:

- Excavated soil and materials,
- Discrete ROs,
- SSSD piping and related system components,
- Discarded personal protective equipment (e.g., Tyvek™ coveralls, latex gloves), and
- Waste generated during survey and removal activities (e.g., paper towels, filters, tape, plastic sheeting, and plastic packaging).

The production of solid waste, un-recyclable, and non-biodegradable wastes was minimized through re-use or recycling of debris found at work sites and by careful use of the appropriate quantity of materials brought onto the site. The types and quantities of chemicals brought onto the site were limited to required quantities.

Waste was classified as LLRW, hazardous waste, or non-LLRW and non-hazardous waste. Waste classification was supported by field observations and laboratory analytical results . LLRW and hazardous waste was transferred to the Navy's base-wide LLRW and hazardous waste contractors and managed under separate waste transportation and disposal contracts. Since the waste was aggregated with waste generated by other HPNS projects, no specific volumes for this project are available. Non-LLRW and non-hazardous waste was disposed by Gilbane. Waste transfer and disposal documentation is included in Appendix O.

9.1 LOW-LEVEL RADIOACTIVE WASTE

Piping debris (clay/metal), manhole concrete, and soil that exceeded the clean-up goals (see Section 2.3) were designated as LLRW. Discarded personal protective equipment and waste generated during survey and removal activities was also treated as LLRW as no attempt was made to survey and release it. The LLRW was shipped to the US Ecology Idaho facility in Grand View, Idaho, for disposal.

Twelve discrete ROs were recovered during the removal action. The ROs were characterized in preparation for disposal. A waste information sheet was prepared for each object that details the analytical information about the source and includes a photograph of the source, radionuclide identification, estimated curie content, and radiological survey information. The information was reviewed by RASO to ensure adequate documentation for disposal as LLRW. Radioactive object data are included in Appendix P.

In 2002, Executive Order D-62-02 by the Governor, State of California (Davis, 2002) established a moratorium on the disposal of "decommissioned materials" (i.e., materials with low residual levels of radioactivity) to Class III landfills and unclassified waste management units. Class II landfills do not accept decommissioned materials.

9.2 HAZARDOUS WASTE

Excavated soil generated from IR Program sites was sampled and analyzed for the associated chemicals of concern in accordance with the SAP. Material was classified as hazardous waste based on chemical sampling analytical results.

9.3 NON-HAZARDOUS WASTE

Based on sample analytical results, railroad ties (and railroad tie material) were considered suitable for release from radiological controls and deemed non-LLRW. The material was disposed as non-hazardous waste at the Keller Canyon Landfill, a California permitted Class I landfill in Pittsburg, California, that accepts decommissioned materials for disposal.

Asbestos waste was transported to the Altamont Landfill in Livermore, California, that accepts friable asbestos wastes.

10.0 DEMONSTRATION OF COMPLETION

The Phase II removal action addressed the remaining site features in Parcel D-1 identified as radiologically impacted in the HRA (NAVSEA, 2004) that were not addressed as part of the Phase I removal action. Specifically, these were:

- Remaining SSSD lines;
- Former NRDL site;
- Ship Berths 14, 21, 22, and 29; and
- Railroad tie stockpiles.

The removal action is deemed to be complete once the removal action objectives are met. The removal action objectives for the Phase II removal action were to: (1) implement the AM (Navy, 2006), and (2) protect the public health and welfare and the environment. Residual radioactivity was demonstrated to be less than the clean-up goals for surface and volumetric activity given in Exhibit 2-2, which satisfies the first objective. The second objective was satisfied by demonstrating that residual radioactivity will result in a TEDE to an average member of the critical (screening) group of less than 12 mrem/yr and an ELCR of less than 3×10^{-4}.

10.1 REMAINING SANITARY SEWER AND STORM DRAINS

The remaining SSSD lines in Parcel D-1, shown in Exhibit 1-2, were excavated and removed. The trenches were characterized and remediated as necessary. An FSS of the excavated trench surfaces was then performed. Soil removed during trench excavation was screened for re-use as backfill. Exhibit 10-1 is a comparison of the upper bound sample results for the trench and backfill, and the resulting dose and risk modeling, versus the clean-up goals (see Section 2.3). No further action is required and unrestricted release is recommended for removal of SSSD lines based on the following:

- Remaining SSSD piping and components were excavated and removed. Excavated trenches were characterized and remediated as necessary. Impacted soil areas with elevated sampling results were sufficiently bounded and remediated.
- Excavated soil was radiologically screened. Analytical results for Ra-226, Cs-137, and Sr-90 from systematic and biased samples collected demonstrate the clean-up goals for volumetric activity have been met for excavated soil re-used as backfill material.
- An FSS of the excavated trench surfaces was performed. Analytical results for Ra-226, Cs-137, and Sr-90 from systematic and biased samples collected from the excavated

trench surfaces demonstrate the clean-up goals for volumetric activity have been met for the trench surfaces.

- Dose and risk modeling of the trench surfaces and the backfill material was performed. Using a conservative exposure scenario, the modeling results demonstrate the clean-up goals for dose and risk have been met.

Exhibit 10-1. SSSD Line Removal Results vs. Clean-Up Goals

Type of Clean-Up Goal	Measurement Parameter	Clean-Up Goal[a]	Upper Bound	
			Trench	Backfill
Volumetric Activity (pCi/g)	Ra-226	1.0	0.655	0.807
	Cs-137	0.113	0.107	0.0968
	Sr-90	0.331	< 0.165	0.151
Dose (mrem/yr)	N/A	12	1.2	0.81
Risk (ELCR)	N/A	3×10^{-4}	2.0×10^{-5}	1.2×10^{-5}

Note:
[a] Source: Section 2.3

Trenches were backfilled with soil materials from one of the following two sources:

- Soil screened and cleared on RSY pads and subsequently meeting the clean-up goals. The soil was accepted upon receipt of written RASO approval. The majority of backfill consisted of this soil.
- Approved on-base import fill from the “Jericho” soil stockpile dedicated for use as SSSD line trench backfill.

Based on the samples collected and analyzed from the trench and excavated soil, the soil concentrations of the radionuclides of concern are less than the clean-up goals. The calculated dose and risk are less than 12 mrem/y with ELCR less than 3×10^{-4}, which support unrestricted release.

10.2 FORMER NRDL SITE

An FSS of the former NRDL site was performed to determine whether residual radioactivity is present in the surface soil at the former NRDL site. Exhibit 10-2 is a comparison of the upper bound results for the former NRDL site versus the clean-up goals. The surface soil meets the clean-up goals based on the following:

- GWS was performed over 100 percent of the former NRDL site. Potential scanning anomalies were investigated and found to represent variability in background. No ROs were found during the FSS.

- Impacted soil areas with elevated sampling results were sufficiently bounded and remediated (or no impacted soil areas with elevated sampling results were found).
- Analytical results for Ra-226, Cs-137, and Sr-90 from systematic samples collected from the former NRDL site demonstrate the clean-up goals for volumetric activity have been met.
- Dose and risk modeling performed using a conservative exposure scenario demonstrates the clean-up goals for dose and risk have been met.

Exhibit 10-2. Former NRDL Site Results vs. Clean-Up Goals

Type of Clean-Up Goal	Measurement Parameter	Clean-Up Goal[a]	Maximum Value
Volumetric Activity (pCi/g)	Ra-226	1.38	0.996
	Cs-137	0.113	0.113
	Sr-90	0.331	0.226
	Pu-239	2.59	N/A[b]
Dose (mrem/yr)	N/A	12	1.2
Risk (ELCR)	N/A	3×10^{-4}	2.5×10^{-5}

Notes:
[a] Source: Section 2.3
[b] No analyses performed; see analyses rules in Section 3.3.1

The surface soil at the former NRDL site was surveyed and sampled in accordance with MARSSIM (DOD et al., 2000) and dose and risk modeling was performed using the survey and sampling results.

10.3 SHIP BERTHS 14, 21, 22, AND 29

An FSS of Ship Berths 14, 21, 22, and 29 was performed to determine whether residual radioactivity was present in the surface soil and structure surfaces (e.g., asphalt, concrete) at the ship berths. Exhibit 10-3 is a comparison of the upper bound results for Ship Berths 14, 21, 22, and 29 versus the clean-up goals. The surface soil and structure surfaces meet the clean-up goals based on the following:

- GWS was performed on 100 percent of the ship berth soil areas. Potential scanning anomalies were investigated and found to represent variability in background. No ROs were found.
- Impacted soil areas with elevated sampling results were sufficiently bounded and remediated (or no impacted soil areas with elevated sampling results were found).

- Analytical results for Ra-226, Cs-137, and Sr-90 from systematic samples collected from the ship berth soil areas demonstrate the clean-up goals for volumetric activity have been met.
- Radiological surveys performed on remaining ship berth structures demonstrate the clean-up goals for surface activity have been met.
- Dose and risk modeling performed using a conservative exposure scenario demonstrates the clean-up goals for dose and risk have been met.

Exhibit 10-3. Ship Berth Results vs. Clean-Up Goals

Type of Clean-Up Goal	Measurement Parameter	Clean-Up Goal[a]	Maximum Value
Volumetric Activity (pCi/g)	Ra-226	1.0	0.843
	Cs-137	0.113	<0.074[b,c]
	Sr-90	0.331	0.326
	Pu-239	2.59	<0.036[c]
Surface Activity (dpm/100 cm^2)	Total Alpha	100	88
	Total Beta	1,000	839
	Removable Alpha	20	14
	Removable Beta	200	29
Dose (mrem/yr)	N/A	12	1.4
Risk (ELCR)	N/A	3×10^{-4}	2.8×10^{-5}

Note:
[a] Source: Section 2.3
[b] Ship Berth 22 location with elevated Cs-137 sample result (0.143 pCi/g) remediated; post-remediation results less than MDC
[c] MDC reported in lieu of sample result which is less than MDC

The surface soil and structure surfaces at Ship Berths 14, 21, 22, and 29 were surveyed and sampled in accordance with MARSSIM (DoD et al., 2000) and dose and risk modeling performed using the survey and sampling results.

10.4 RAILROAD TIE STOCKPILES

The railroad ties were radiologically surveyed, released from radiological controls, and disposed as non-LLRW. None of the railroad tie material was found to have residual radioactivity exceeding the clean-up goals (see Section 2.3).

11.0 COMMUNITY RELATIONS

The public outreach process was conducted in accordance with the *Community Involvement Plan Update, Hunters Point Naval Shipyard, San Francisco, California* (Navy, 2014) prepared for HPNS to facilitate community involvement in the decision-making process.

11.1 PUBLIC INFORMATION

The AM (Navy, 2006), the work plans and reports discussed in Section 1.5, and other documentation associated with remediation activities at HPNS are contained in the Environmental Restoration Program Record File for the site. The Environmental Restoration Program Record File is maintained by Naval Facilities Engineering Command Southwest. The Navy, as lead agency with state agency concurrence, has overall responsibility for public participation activities. As such, the above information concerning Parcel D-1 is also available to the public at two local information repositories: the City of San Francisco Main Library and the Hunters Point Naval Shipyard Library (located near the entrance to the base). The information repositories are where the public can review any of the documents associated with the Environmental Restoration Program Record File. Public Participation

To encourage local participation in the hazardous waste clean-up program at HPNS, the Navy hosts community meetings. The meetings include presentations of on-going clean-up work at HPNS to inform the public.

The Navy hosted community meetings on April 9, September 2, and December 2, 2015, and April 13, 2016 to apprise community members of the remediation work being performed at HPNS. At each of the meetings, all meeting attendees were invited to ask questions of the Navy and its contractor and were encouraged to join breakout sessions to discuss and ask representatives from the regulatory agencies questions about the remediation activities at HPNS. The Navy also updated the regulatory agencies on the progress of the project, and that information was relayed to the community through a variety of agency outreach initiatives.

12.0 REMOVAL ACTION COSTS

A summary of the estimated costs incurred to perform the Phase II radiological remediation and support activities at Parcel D-1 as reported in this RACR are shown in Exhibit 12-1. The cost of this removal action is approximate due to other Navy contractors performing portions of the removal action activities, such as off-site transportation and disposal.

Exhibit 12-1. Parcel D-1 Phase II Removal Action Costs

Activity	Cost
Project Management and Plans	$315,000
Field Work (mobilization/demobilization, removal actions, site restoration)	$6,800,000
Reporting and Technical Memorandums	$458,000
Total Costs[a]:	$7,537,000

Note:
[a]does not include LLRW and non-LLRW processed by the Basewide Radiological Contractor and the non-LLRW Navy transportation and disposal contractor to avoid double-counting of waste costs reported in other RACRs and /or reports.

13.0 CONCLUSIONS

The close-out of the Phase II removal actions, in conjunction with the close-out of the Phase I removal actions (Shaw, 2014), completes the radiological remediation of site features identified by the HRA (NAVSEA, 2004) in Parcel D-1 as radiologically impacted. This included the radiological surveying, sampling, and remediation performed in Parcel D-1 related to:

- SSSD line removal;
- Former NRDL site FSS;
- Ship Berths 14, 21, 22, and 29 FSS; and
- Railroad tie stockpile survey and disposal.

There are no remaining site features in Parcel D-1 identified as radiologically impacted in the HRA (NAVSEA, 2004) that have not been addressed.

13.1 CLEAN-UP GOALS

Survey and sample results were quantitatively compared to the clean-up goals for HPNS established in the AM (Navy, 2006) for the radionuclides of concern identified in the HRA (NAVSEA, 2004). Material found to be above the clean-up goals has been properly disposed of off-site. An FSS has been performed and/or survey and sample results provided to justify that surface soil and other material left in-place and/or re-used as backfill meet the clean-up goals. Consistent with the ROD (Navy, 2009), further remedial actions (implementation of land use and activity restrictions) will occur to address risk associated with the potential for ROs in material below 2 ft bgs.

13.2 DOSE AND RISK MODELING

Dose and risk modeling was performed in RESRAD using sample analytical results. Modeling resulted in a maximum dose of 1.4 mrem/yr and a maximum ELCR of 2.8×10^{-5}. This demonstrated that the residual dose and risk, under the conservative residential farmer exposure scenario, were below the project dose limit of 12 mrem/yr and an ELCR of 3×10^{-4}. The planned future use of Parcel D-1 ranges from recreational to residential use. Since existing land use and activity restrictions at HPNS prohibit the consumption of food grown on-site, the ingestion-related pathways included in the modeling are another layer of conservatism that assures dose and risk results are well within project limits based on planned future re-use.

Turning off the ingestion-related pathways in the model – making the model consistent with the food consumption restrictions - reduces the maximum dose and risk by 50 percent. The maximum dose drops from 1.4 to 0.63 mrem/yr. The maximum ELCR drops from 2.8×10^{-5} to 1.4×10^{-5}. These dose and risk results are more appropriate because they reflect actual site conditions for the residential scenario, which is the most conservative planned future use. The RESRAD dose and risk results for the survey unit presenting the maximum dose and risk (Ship Berth Survey Unit 04-PD-SB-14S) are provided in Appendix Q.

Discrete ROs may exist in material below 2 ft bgs (see Section 13.3). However, their discrete form and buried condition severely restricts their ability to contribute significantly to external, inhalation, or ingestion exposure pathways.

13.3 DISCRETE RADIOACTIVE OBJECTS

Once the Phase II removal actions were completed, survey and sampling were performed over a large portion of Parcel D-1 based on radiation anomalies that were identified outside of areas identified as radiologically impacted. Discrete ROs were subsequently recovered. There are two important points to be made:

- ROs recovered outside of areas previously identified by the HRA (NAVSEA, 2004) as radiologically impacted do not appear to be from surface-related activities involving radioactive material. Their suspected source is material dredged from San Francisco Bay used to create the present shoreline. Since radioluminescent devices containing Ra-226 were used on ships, ship decontamination, repair, and dismantling activities occurring at or near piers could have resulted in deck markers, gauges, and small metal pieces being present in the dredge material.
- Based on the post-removal survey and sampling results, there is a high degree of confidence that discrete ROs in soil to a depth of 2 ft bgs have been identified and recovered.

Based on the above, there is the potential for ROs to be present in material below 2 ft bgs in Parcel D-1 Phase II areas where shoreline expansion has occurred in Parcel D-1 since 1946 (i.e., where dredge material from the Bay was used to create the present shoreline). Based on the Navy's understanding of how shoreline expansion occurred, the potential is largely limited to areas around the 1946 shoreline. The likelihood of ROs moving away from the 1946 shoreline is considered incidental and of low probability.

Land use and activity restrictions that are currently in place prohibit land-disturbing activities throughout Parcel D-1 in the interim until the LUC RD (ChaduxTt, 2011) is amended to appropriately mitigate any risk to human health relating to the potential presence of ROs in material below 2 ft bgs.

14.0 CERTIFICATION STATEMENT

I certify that this RACR memorializes the completion of the Phase II removal actions conducted in Parcel D-1 at the former HPNS. The Phase II removal actions achieved the radiological removal action objectives identified in the AM (Navy, 2006) for the remaining site features in Parcel D-1 identified as radiologically impacted in the HRA (NAVSEA, 2004) that were not addressed in the Phase I removal actions. The single provision is that notifications of the potential for ROs to be present in material below 2 ft bgs in Parcel D-1 Phase II areas where dredge material from the Bay was used to create the present shoreline is required in the Finding of Suitability to Transfer. This is necessary in order to inform procedures that may be needed if intrusive site activities below 2 ft bgs are performed in the future at Parcel D-1.

There are no remaining site features in Parcel D-1 identified as radiologically impacted in the HRA (NAVSEA, 2004) that have not been addressed. No additional construction activities for remediated areas are anticipated at this time, thus the removal action is deemed complete.

BRAC Environmental Coordinator Hunters Point Naval Shipyard	MAY 31, 2018 Date

15.0 REFERENCES

Argonne National Laboratory (ANL), 2014. RESidual RADioactivity (RESRAD) for Windows, Version 7.0. February.

California Department of Public Health (CDPH), 2012. Radiation Solution RS-700: Operation Procedure, Version 4, RS 700 Instruction Manual. CDPH Radiological Health Branch, Radiological Assessment Unit.

ChaduxTt, 2011. *Final Design Basis Report For Parcel D-1, Hunters Point Shipyard, San Francisco, California*.

U.S. Department of Defense (DoD), U. S. Department of Energy, U. S. Nuclear Regulatory Commission, and U. S. Environmental Protection Agency, 2000. *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM). August (NUREG-1575).

Davis, 2002. Executive Order D-62-02 by the Governor, State of California, Gray Davis, dated September 30, 2002.

U.S. Environmental Protection Agency (EPA), 2014. OSWER Directive 9200.4-40, R*adiation Risk Assessment at CERCLA Sites: Q&A*. June (EPA 540-R-012-13).

Gilbane Federal (Gilbane), 2016a. *Survey Unit Project Reports Abstract, Parcel D-1 Phase II Sanitary Sewer and Storm Drain Removal, Hunters Naval Point Shipyard, San Francisco, California*. Final. January.

Gilbane, 2016b. *Survey Unit Project Reports (Work Package 108): Zones A, B, C, D, and E; Parcel D-1 Phase II Sanitary Sewer and Storm Drain Removal, Hunters Point Naval Shipyard, San Francisco, California*. Final. January.

Gilbane, 2016c. *Survey Unit Project Reports (Work Package 109): Zones F, G, H, I, and J; Parcel D-1 Phase II Sanitary Sewer and Storm Drain Removal, Hunters Point Naval Shipyard, San Francisco, California*. Final. January.

Gilbane, 2016d. *Survey Unit Project Reports (Work Package 110): Zones K, L, M, N, and O; Parcel D-1 Phase II Sanitary Sewer and Storm Drain Removal, Hunters Point Naval Shipyard, San Francisco, California*. Final. January.

Gilbane, 2016e. *Survey Unit Project Reports (Work Package 111): Zones P and Q; Parcel D-1 Phase II Sanitary Sewer and Storm Drain Removal, Hunters Point Naval Shipyard, San Francisco, California*. Final. January.

Gilbane, 2017a. Draft Report for *Final Status Survey of the Former Naval Radiological Defense Laboratory Site, Hunters Point Naval Shipyard, San Francisco, California*. July.

Gilbane, 2017b. Draft Report for *Final Status Survey: Ship Berths 14, 21, 22, and 29, Hunters Point Naval Shipyard, San Francisco, California*. July.

International Atomic Energy Agency (IAEA), 1991. *Airborne Gamma-Ray Spectrometer Surveying*, Technical Report 323.

ITSI Gilbane, 2013a. *Basewide Radiological Management Plan, Hunters Point Naval Shipyard, San Francisco, California*. Final. July.

ITSI Gilbane, 2013b. *Execution Plan: Parcel D-1 Phase II Radiological Remediation and Support, Hunters Point Naval Shipyard, San Francisco, California*. Final. July.

ITSI Gilbane, 2013c. *Parcel D-1 Phase II Design Plan: Storm Drain and Sanitary Sewer Removal, Hunters Point Shipyard, San Francisco, California*. Final. August.

ITSI Gilbane, 2013d. *Task-Specific Plan: Former Naval Radiological Defense Laboratory Site Final Status Survey, Hunters Point Naval Shipyard, San Francisco, California*. Final. October.

ITSI Gilbane, 2013e. *Task-Specific Plan: Radiological Survey and Release of Ship Berths 14, 21, 22, and 29, Hunters Point Naval Shipyard, San Francisco, California*. Final Revision 1. December.

Naval Sea Systems Command (NAVSEA), 2004. *Historical Radiological Assessment, Hunters Point Annex, Volume II, History of the Uses of General Radioactive Material 1939–2003*. Final. August.

U.S. Department of the Navy (Navy), 2006. *Final Base-wide Radiological Removal Action, Action Memorandum – Revision 2006, Hunters Point Shipyard, San Francisco, California*. April.

Navy, 2008. Memorandum: *Conceptual Site Model for the Removal of the Sanitary and Storm Sewers at Hunters Point Shipyard, San Francisco, California*. December 11.

Navy, 2009. *Draft Record of Decision for Parcels D-1 and UC-1, Hunters Point Shipyard, San Francisco, California*. February.

Navy, 2014. *Community Involvement Plan Update, Hunters Naval Point Shipyard, San Francisco, California*. Final. October.

San Francisco Redevelopment Agency, 2010. *Hunters Point Shipyard Redevelopment Plan*.

Shaw Environmental & Infrastructure, Inc. (Shaw), 2014. *Radiological Removal Action Completion Report: Radiological Surveys of Buildings and Ground Surfaces, and Storm Drain and Sanitary Sewer Removal, Parcel D-1, Phase I, Hunters Point Naval Shipyard, San Francisco, California*. Final. January.